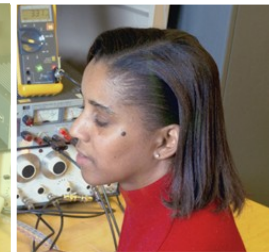
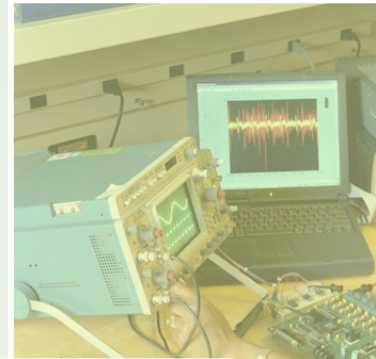
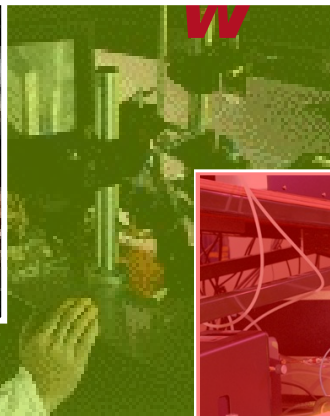
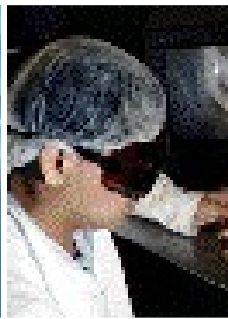
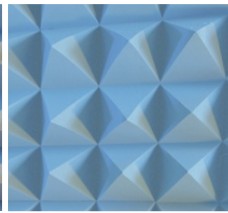




COLLABORATIVE TECHNOLOGY ALLIANCE

Overview

W



U.S. ARMY
RESEARCH
LABORATORY



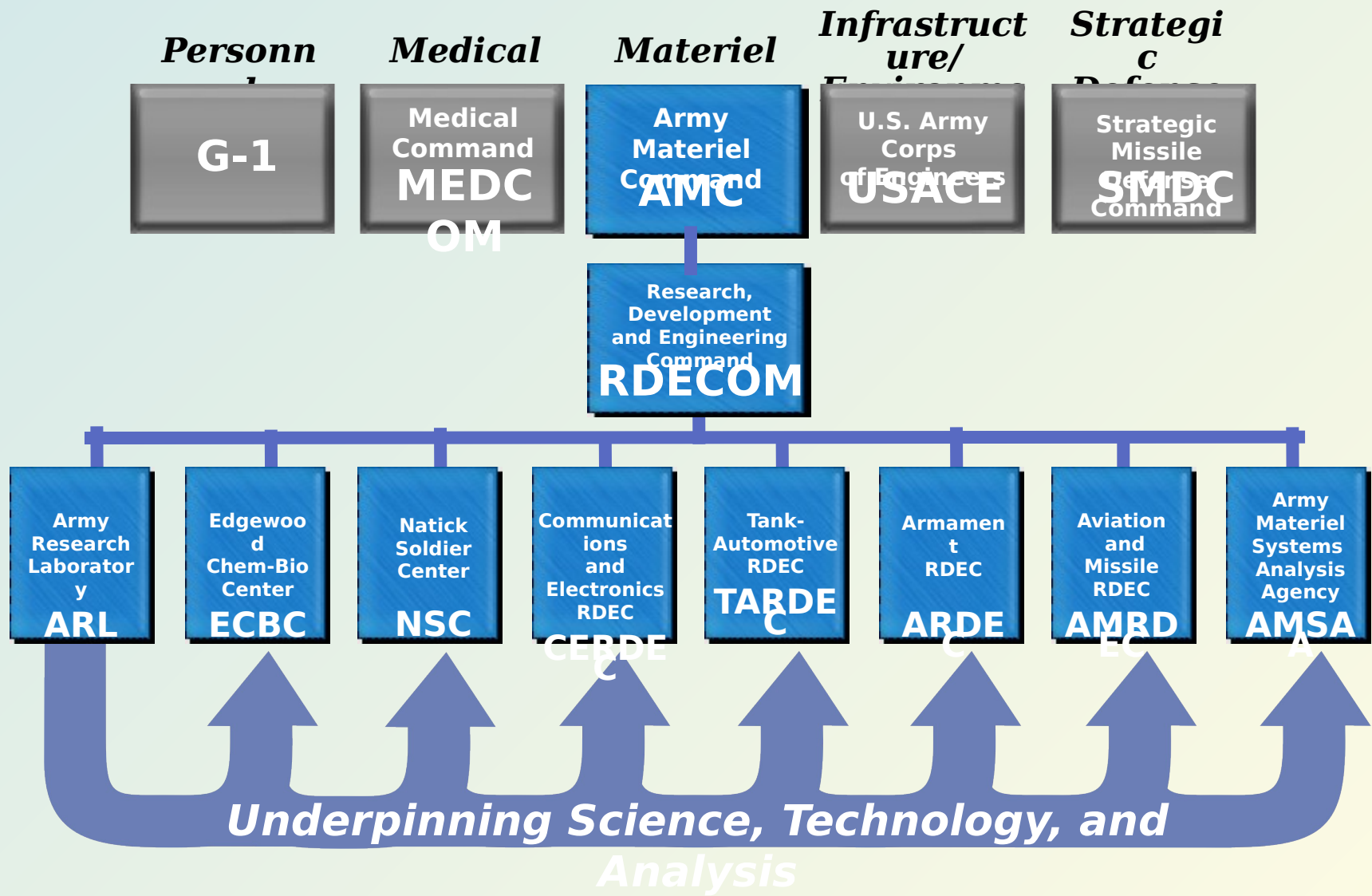
U.S. ARMY RESEARCH LABORATORY

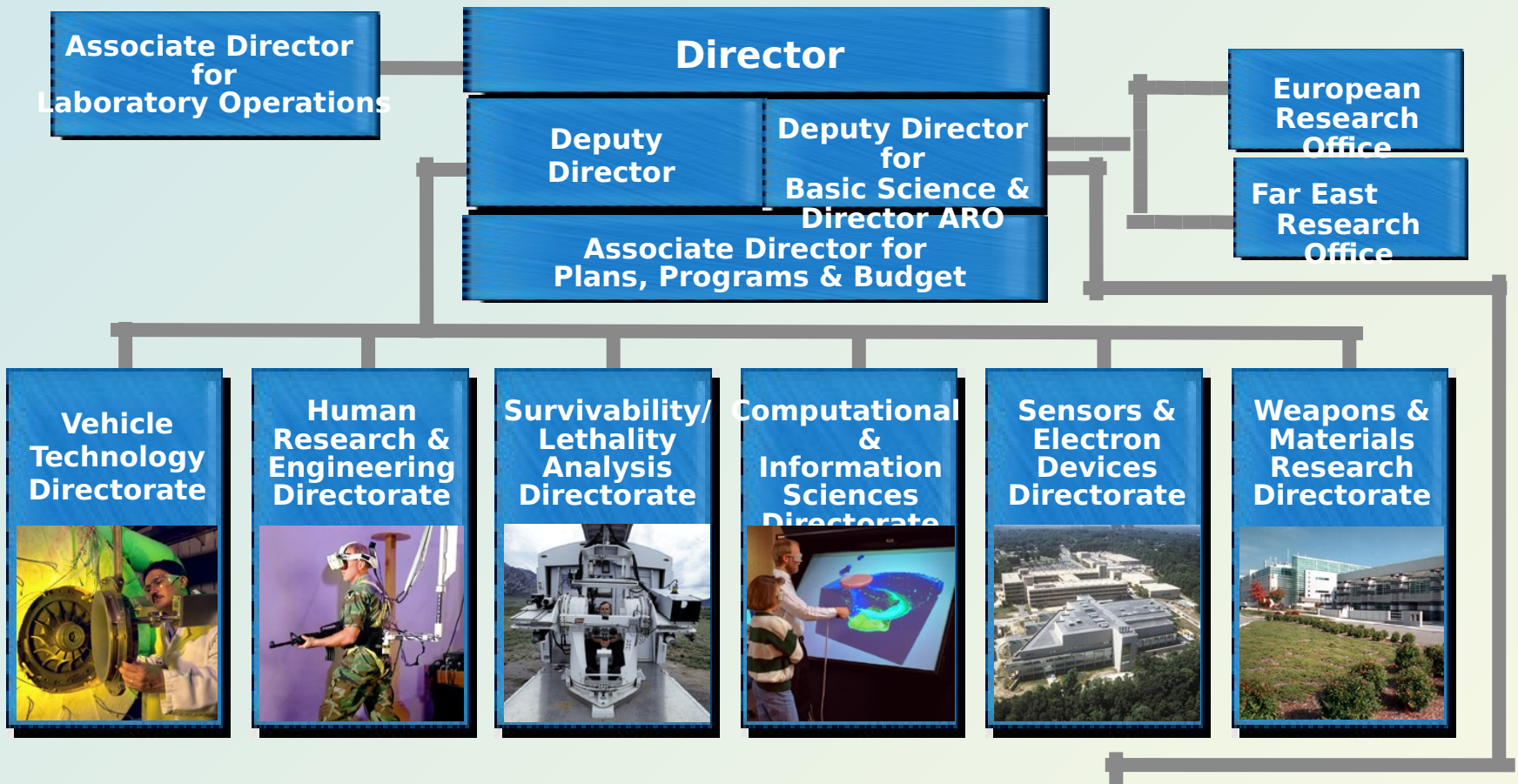
Mission

***Provide innovative
science, technology
and analyses, to
enable
full spectrum
operations.***



Army S&T Performing Organizations





U.S. Army Research Laboratory Organizations



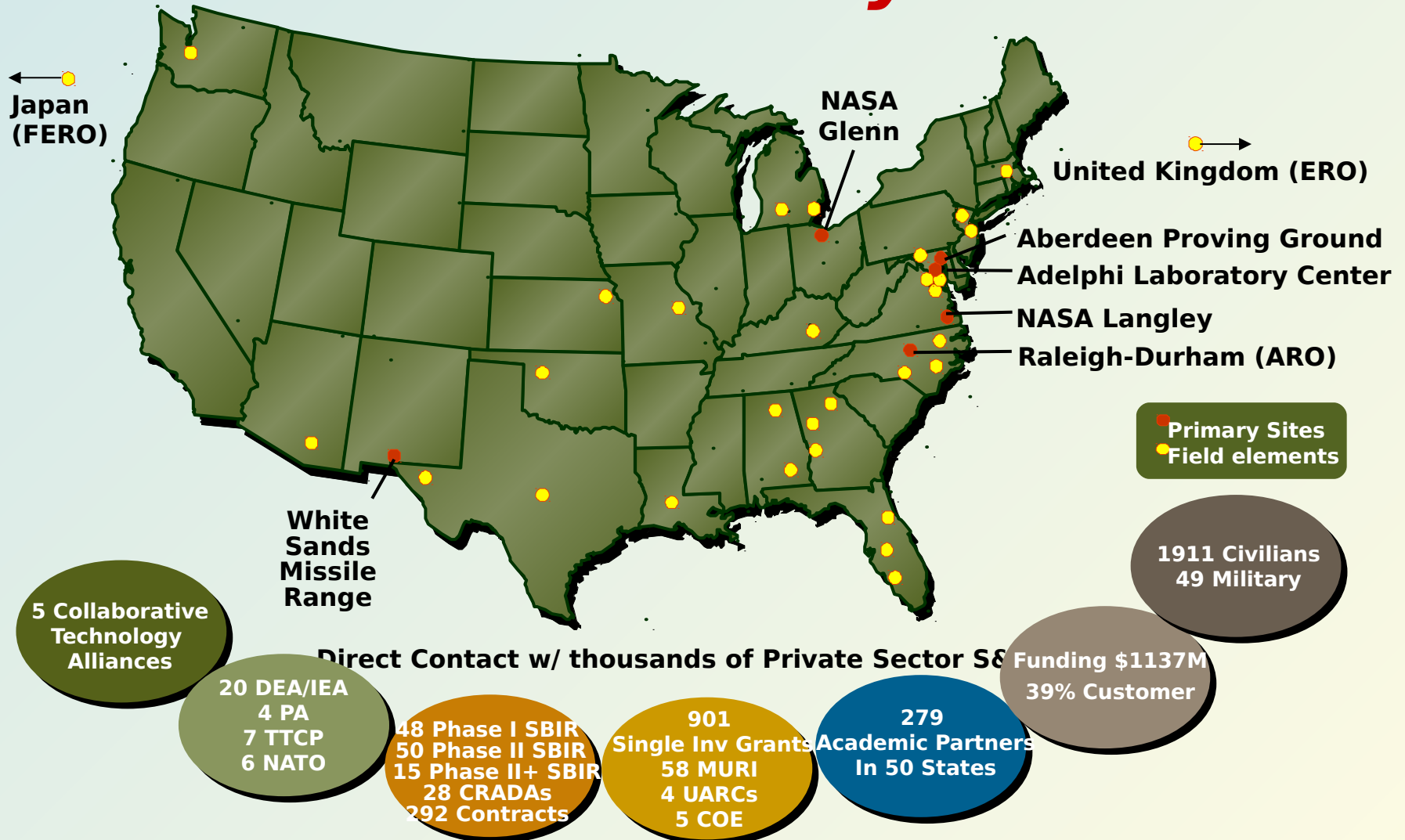


Army Research Laboratory

Science
6.1

Technology
6.2

Analysis
6.6



FY04 Data

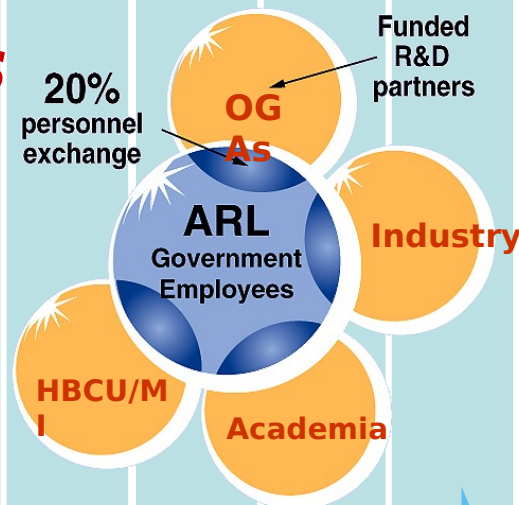


Innovative Partners with the Private Sector

FEDERATED LABORATORY

- Competitive selection in FY96
- Collaborative management and execution of research program
- Funded at \$125 M over five years
- Focused on battlefield digitization
 - Advanced Sensors
 - Telecommunications
 - Advanced Displays
- Many products transitioned

ARL Partnerships with Private Sector



COLLABORATIVE TECHNOLOGY ALLIANCES

- Follow-on to FedLab (FY01 start)
- Includes other government agencies
- Task order contracts linked to cooperative agreements to facilitate product transitions
- \$300 M projected over eight years (for the Cooperative Agreements)
- Focused on Transformation
 - Advanced Sensors
 - Adv. Decision Architectures
 - Communications & Networks
 - Robotics
 - Power & Energy

1996 1997 1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009



Some Federated Laboratory Accomplishments

From the Sensors Consortium

- First ever two-color longwave/midwave handheld infrared camera to CECOM/NVESD
- Longwave/Longwave Focal Plane Array to CECOM/NVESD
- Electromagnetic Modeling Algorithm for Minefield detection using UWB Radar to CECOM/NVESD
- Low Power Digital Signal Processing Chip to Draper Labs

From the Advanced & Interactive Displays Consortium

- Human Factors engineering practices, methods, and metrics for soldier cognitive capabilities to CECOM
- Suite of Decision Analysis Tools to CECOM, INSCOM and TRADOC Battlelabs
- Multimodal Sensory Fusion Architecture for synchronous actions at all levels of C4I to INSCOM and to DARPA

From the Telecommunications & Information Distribution Consortium

- Orthogonal Frequency Division Multiplexing systems to CECOM
 - Autonomous assurance system (a world first) to CECOM
 - Dynamic Registration and Configuration Protocol (DRCP) and Dynamic Configuration Distribution Protocol (DCDP) to the IETF
 - Temporally-Ordered Routing Algorithm and Mobile Ad Hoc Networking (MANET) authentication and encapsulation protocols to IETF
- Plus**
- 76 Patent Disclosures

302 peer reviewed journal articles

983 technical presentations and publications

214 Master's and **254** PhD degrees supported by the FedLab efforts

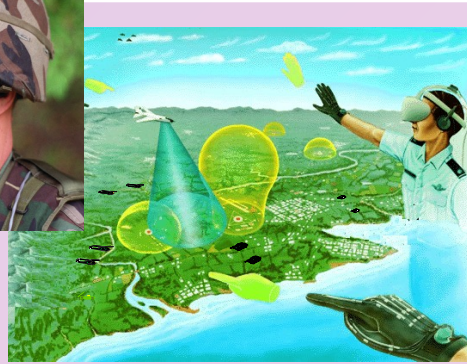


Collaboration among Government-Industry-University researchers to achieve affordable transition of innovative technologies

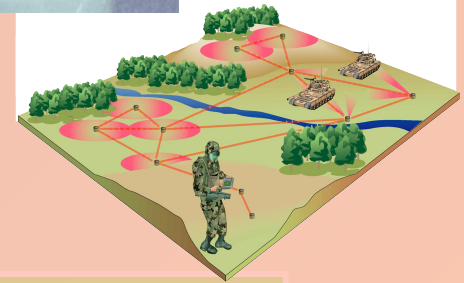
- Identify unique Army problems critical to realizing the Objective Force Vision that the commercial sector is not solving
- Focus research on technologies to solve these problems
- Jointly plan and execute collaborative basic research with our private sector partners in conjunction with Army RDECs, other Service and non-DoD laboratories
- Leverage fast-moving commercial sector technology deployment
- Transition state-of-art technology from the commercial world to the military tech base



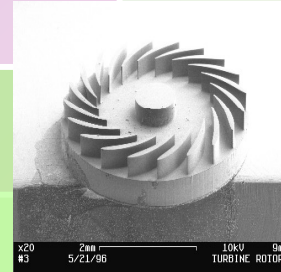
Technology for Army Transformation



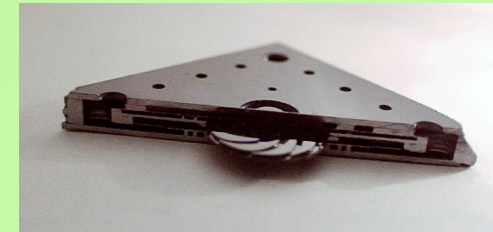
***Advanced
Decision
Architectures***



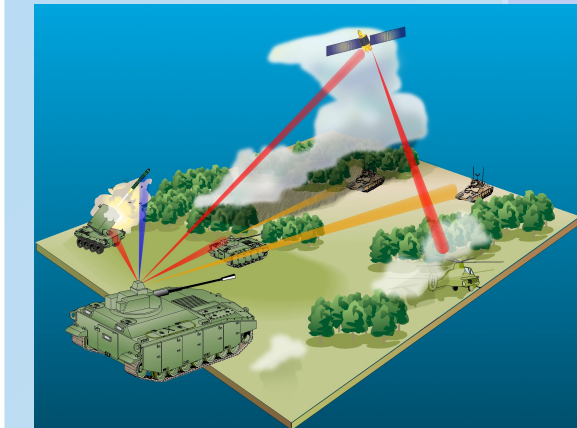
***Communication
& Networks***



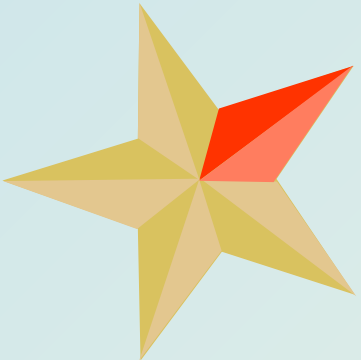
Robotics



Power & Energy



Advanced Sensors



COLLABORATIVE TECHNOLOGY ALLIANCE

Communications and Networks

Objectives

Enable a fully-mobile, agile, situation-aware, and survivable lightweight force with internettted C⁴ISR systems.

- ***Operate while on-the-move with a highly mobile network infrastructure***
- ***Under severe bandwidth and energy constraints***
- ***While providing secure, jam-resistant comms in noisy hostile wireless***

Technical Areas

- **Survivable Wireless Mobile Networks**
- **Signal Processing for Comms-on-the-Move**
- **Secure Jam-Resistant Communications**
- **Tactical Information Protection**

Consortium Partners

- **Telcordia Technologies (Lead)**
- **Network Associates**
- **BBN Technologies**
- **General Dynamics**
- **BAE SYSTEMS**
- **Georgia Tech**
- **U of Maryland**
- **U of Minnesota**
- **U of Delaware**
- **Princeton**
- **Johns Hopkins**
- **Morgan State**
- **CCNY**
- **Clark-Atlanta**





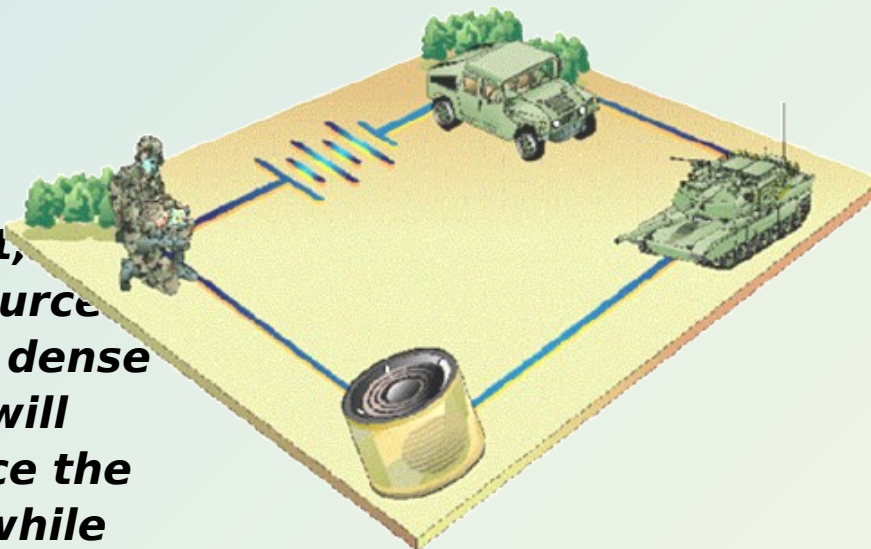
COLLABORATIVE TECHNOLOGY ALLIANCE

Power and Energy

Objectives

Technologies that enable lightweight, compact power sources and highly power dense components that will significantly reduce the logistics burden, while increasing the survivability and lethality of the soldiers and systems of the highly mobile mounted and dismounted forces of the Army's Objective Force.

- Air-breathing, fueled compact power sources
- Reformate fuels for power systems
- Highly power dense, high temperature power



Technical Areas

- Portable, Compact Power Sources (Non-electrochemical)
- Fuel Cells and Fuel Reformation
- Hybrid Electric Propulsion and Power

Consortium Partners

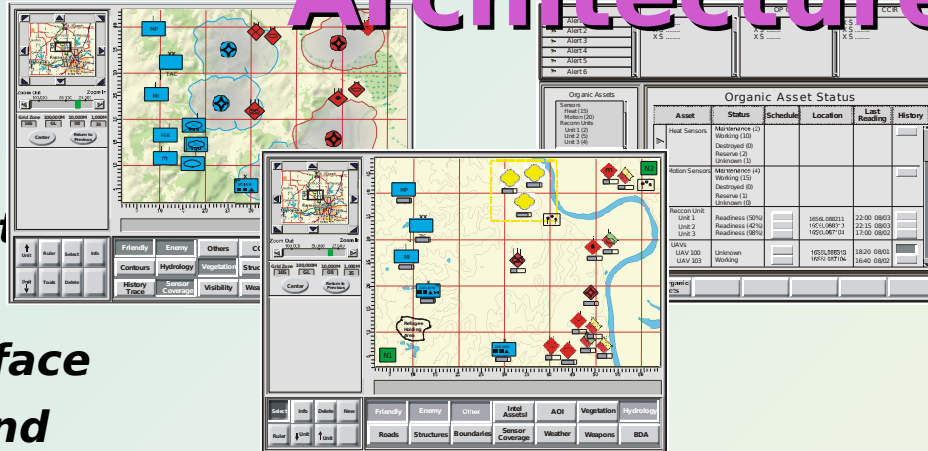
- Honeywell
- MIT
- Clark Atlanta
- Georgia Tech
- U of Maryland
- Motorola Labs
- NuVant Systems
- Case Western Res U
- Illinois Inst of Tech
- Penn State Univ
- Tufts Univ
- U of Minnesota
- U of New Mexico
- U of Pennsylvania
- U of Puerto Rico
- U of Texas - Austin
- SAIC
- Rockwell Science Center
- United Defense LP
- Prairie View A&M
- Rensselaer Polytechnic
- Texas A&M

COLLABORATIVE TECHNOLOGY ALLIANCE

Advanced Decision Architectures

Objectives

Work together to develop, test and transition new user-interface technologies and computer science innovations that will facilitate better soldier understanding of the tactical situation, more thorough evaluation of courses of action, and, ultimately, better and more timely decisions.

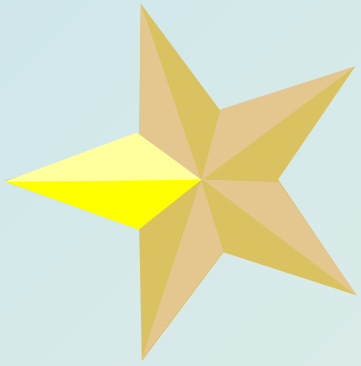


Consortium Partners

- Micro Analysis & Design, Inc.
- Klein Associates
- SA Technologies
- ArtisTech, Inc.
- SAIC
- Ohio State University
- New Mexico State University
- University of West Florida
- Massachusetts Institute of Technology
- Carnegie Mellon University
- University of Central Florida
- University of Maryland

Technical Areas

- Cognitive Process Modeling and Measurement
- Analytical Tools for Collaborative Planning and Execution
- User-Adaptable Interfaces
- Auto Adaptive



COLLABORATIVE TECHNOLOGY ALLIANCE

Robotic

Objectives

Develop and evaluate:

- Perception technologies enabling semi-autonomous robotic vehicles to maneuver with speed and agility over a wide array of terrain types in varied weather conditions
- Intelligent control technology integrating “tactical behaviors” supporting complex sequences of activity appropriate to the tactical situation
- Human-machine interfaces enabling effective direction and control of robotic systems while minimizing operator workload
- Modeling and simulation technology providing robotics researchers unprecedented ability to design and evaluate new robotic vehicle perceptual capabilities and tactical behaviors responsive to evolving operational



Technical Areas

- Perception
- Intelligent Control & Behaviors
- Human-Machine Interface
- Modeling, Simulation & Experimentation

Consortium Partners

- GD Robotic Systems (Lead)
- JPL
- BAE Systems
- ASI
- Micro Analysis & Design
- Carnegie Mellon U
- U of Maryland
- Florida A&M
- SRI International
- Sarnoff
- Science & Engr Sys
- PercepTek
- Signal Systems
- AAI



COLLABORATIVE TECHNOLOGY ALLIANCE

Advanced Sensors

Objectives

Technologies that increase sensor performance and utility, and techniques to combine many types of data to provide timely and meaningful information to the soldier.

Affordable sensors that provide:

- Continuous situation awareness
- Rapid, precise detection and ID of camouflaged targets
- Environmental sensing for navigation and self-defense



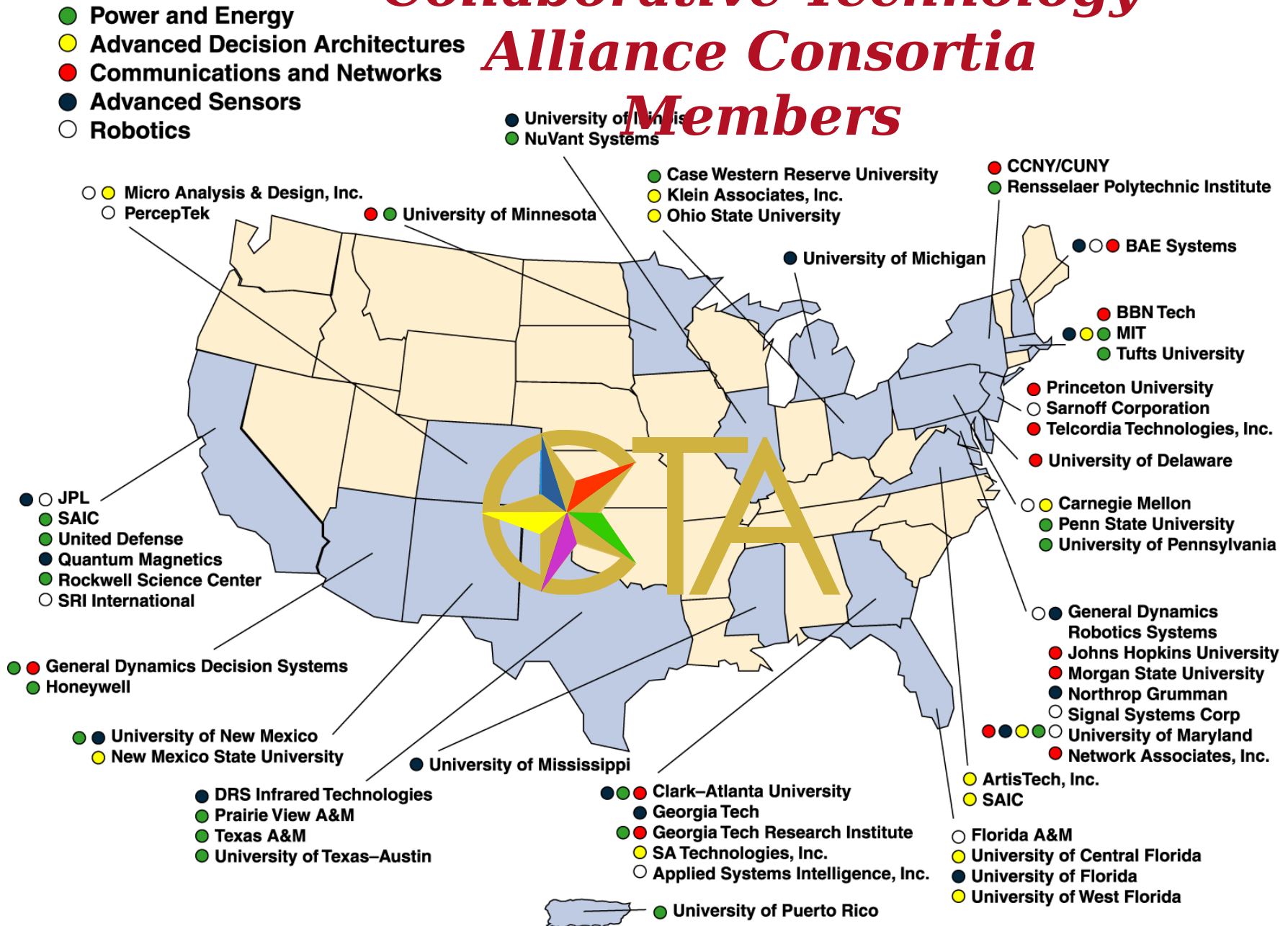
Technical Areas

- Microsensors
- Electro-Optic Smart Sensors
- Advanced RF Concepts

Consortium Partners

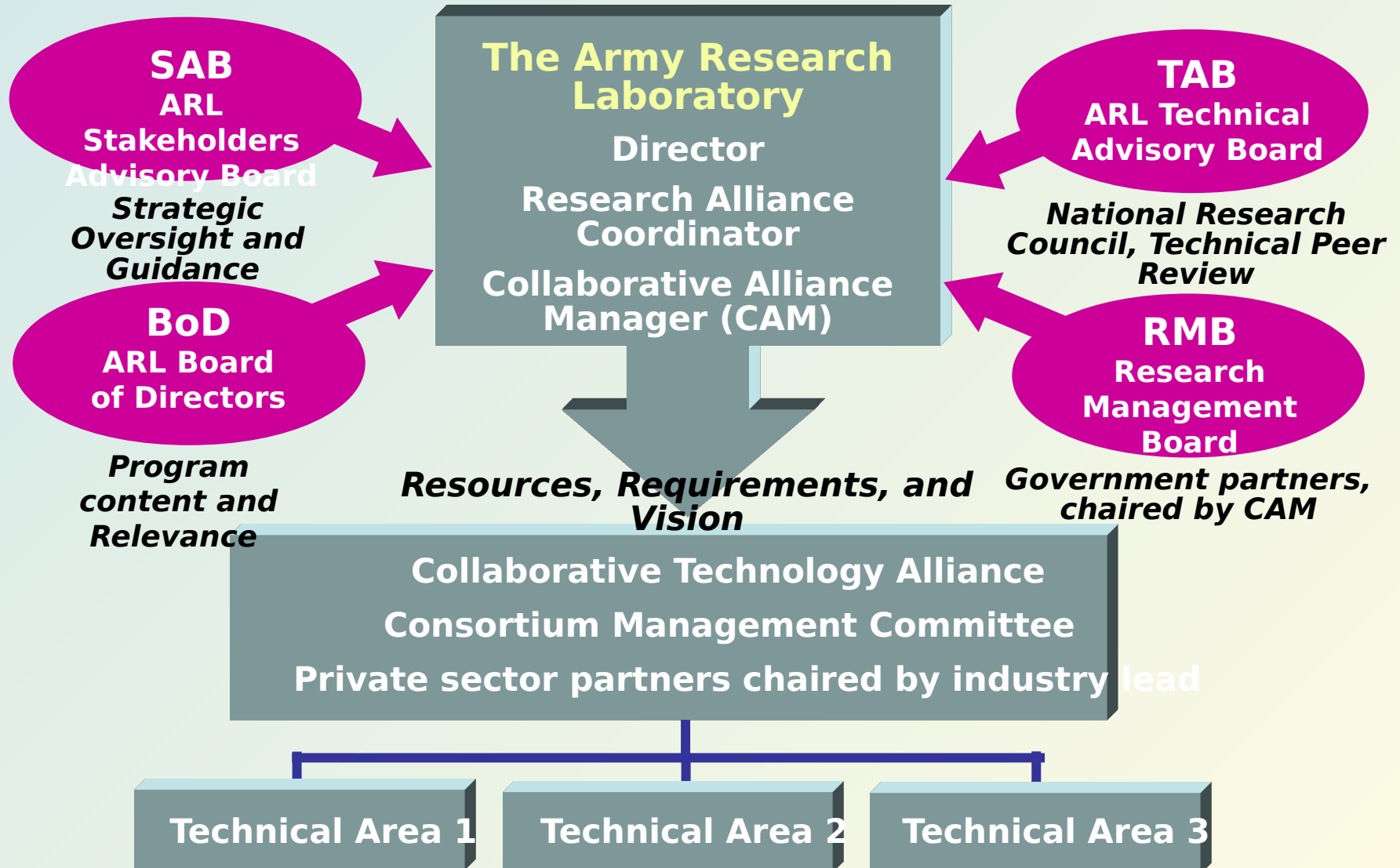
- GD Robotic Systems (Lea
- JPL
- BAE Systems
- ASI
- Micro Analysis & Design
- Carnegie Mellon U
- U of Maryland
- Florida A&M
- SRI International
- Sarnoff
- Science & Engr Sys
- PercepTek
- Signal Systems
- AAI

Collaborative Technology Alliance Consortia Members





Alliance Management Structure





Research Management Board

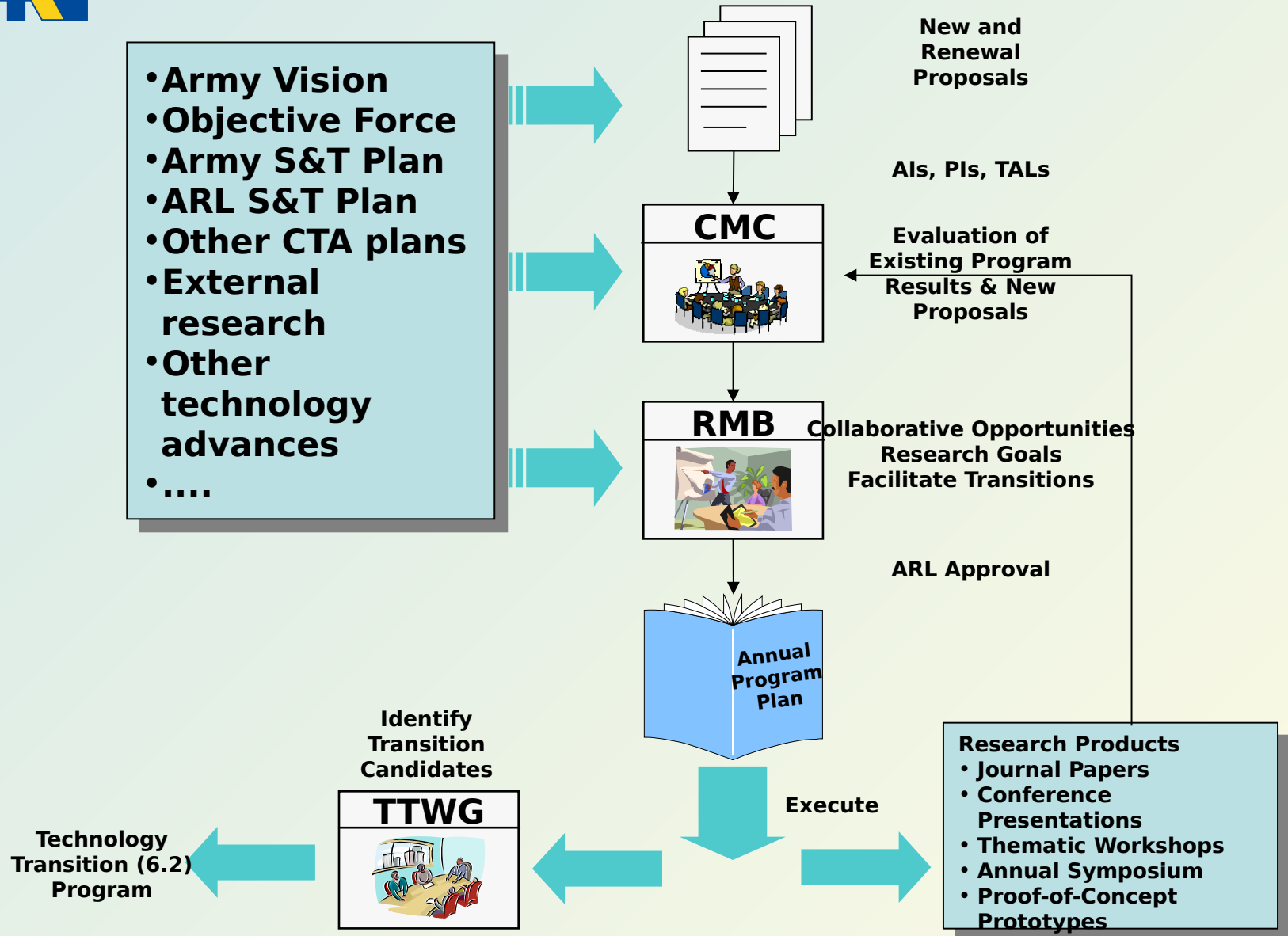
- **One RMB established for each CTA to:**
 - ◆ Identify and develop collaborative opportunities
 - ◆ Advise and assist the CAM in setting research goals
 - ◆ Facilitate transition to development programs
- **RMBs include membership from:**
 - Army organizations
 - Other Services
 - OGAs with interest and/or expertise in the CTA technology
- **Meet one or two times per year**
- **Task order contract available to facilitate collaborative research and technology transition**

Strategic
Guidance
for the
CTA





APP Planning Process





Some CTA Accomplishments

From Advanced Decision Architectures

- Improved soldier survivability with decision making tools improving collaborative situation awareness and reducing soldier workload
- “Shared displays” technology to enable Soldiers to identify enemy targets and to indicate attack approaches; possible use in Iraq.

From Advanced Sensors

- Infrared detectors enabled simpler, cheaper imagers for improved detection of camouflaged and low-observable targets
- More effective detection of freshly buried mines and improvised explosive devices

From Communications and Networks

- Protocols that enable more rapidly deployable mobile networks automatically

- Transitioned to CERDEC MOSAIC ATD methods for auto-configured network domains

\$38M from other agencies placed on transitions contract
Over 600 refereed papers, conference presentations and proceedings

60 workshops, seminars, and short courses conducted

38 Master's, **44** PhD degrees completed; sponsored **106** Post doctoral fellows

From Power and Energy

- Demonstrated Direct Methanol Fuel Cell breadboard with potential for five times more power over present soldiers' battery pack
- Improvements in high temperature materials to enable the microturbine to reach its 5 to 10 fold increase in power density projections

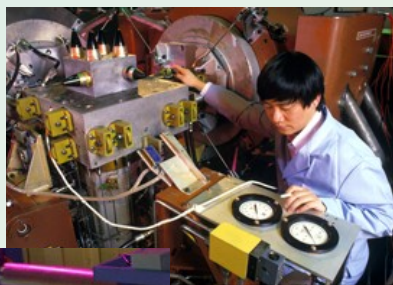
From Robotics

- Breakthrough in the ability of intelligent unmanned ground vehicles to perceive and autonomously navigate
- complex, unstructured terrain with minimal human supervision
- Transitioned technology to send vehicles on autonomous missions to the Army's Autonomous Navigation systems program and TARDEC's Vetronics Technology integration program

Plus



America's Laboratory for the Army



Survivability

Lethality

Mobility

Power & Energy

Basic Research

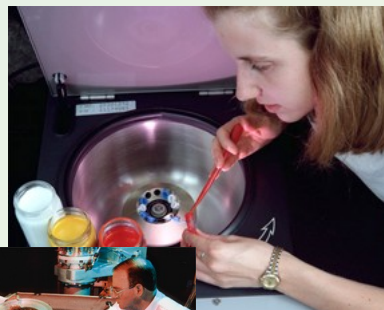
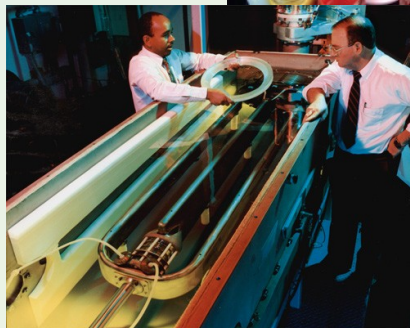


C4

Sensors

**Human
Dimension**

Analysis



***Many Minds,
Many
Capabilities,
Multiple
Pathways***